T-Wave Alternans and Sudden Cardiac Death

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Abstract: Sudden cardiac death (SCD) is the leading cause of mortality in patients with ischemic heart disease and left ventricular dysfunction. The majority of SCD are due to ventricular tachyarrhythmias. SCD strikes many asymptomatic patients and often is the first manifestation of heart disease. Thus, reliable determination of arrhythmic risk is warranted to guide preventive therapy. To highlight the prognostic value of microvolt-level electrical alternans of the T-wave (MTWA) in patients at risk for SCD, most of the pertinent published articles in the Medline, Scopus, and EBSCO Host research databases have been reviewed. MTWA has been proposed to be a strong and independent predictor of all-cause and arrhythmic mortality. The high predictive value of MTWA in patient with cardiomyopathy varies significantly depending on the population studied. Combining with other indices or having serial MTWA readings could overcome MTWA limitations. Redefining MTWA readings may expand its prognostic utility.

Key Words: T-Wave alternans, sudden cardiac death, cardiomyopathy

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T-Wave Alternans

MTWA is an ECG phenomenon defined as beat-to-beat alternation of the morphology, amplitude, and/or polarity of the T-wave. It refers to alternation of the electrocardiographic ST-segment, T- and U-wave. Visible MTWA of increasing subtlety has been reported in patients with ischemia, long QT syndrome (LQTS), electrolyte disturbances, and conversion from tachycardia, and consistently linked with VTs. The use of MTWA relies upon microvolt level fluctuations that are invisible to the eye but required computerized signal processing methods to be demonstrated. In some cases, MTWA performed better than SAECG and electrophysiologic study (EPS) in predicting arrhythmic events.

T-Wave Alternans and SCD

Recently, MTWA has been considered as a promising new way of determining arrhythmia vulnerability. Many studies link MTWA with inducible clinical ventricular arrhythmias, and with basic mechanisms leading to their initiation. Kodama et al reported that MTWA was sufficiently large as to be visible in 8% to 10% of patients with cardiomyopathy (CM) especially during episodes of emerging tachycardias or aderenergic stimulation with dobutamine. Another 2 studies reported cases of spontaneous (ventricular fibrillation, VF) emerging from background of macroscopic MTWA during telemetered clinical monitoring. During ambulatory recording in patients, the amplitude of MTWA significantly increases 30 to 60 minutes preceding the onset of sustained ventricular arrhythmia. The magnitude of repolarization instability, manifested by MTWA and beat-to-beat oscillations of T-wave amplitudes at other frequencies, increased before the onset of ventricular arrhythmias. Thus, MTWA is a direct measure of ventricular repolarization instability and it identifies a particular arrhythmogenic substrate in which hemodynamically well tolerated VT may degenerate into terminal VF.